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955 L'ENFANT PLAZA NORTH, S.W.

WASHINGTON, D.C. 20024

SUBJECT: Review of AAP ICD 50M13136,
AAP Audio System Criteria
Case 620

DATE: January 28, 1969

FROM: A. G. Weygand

MEMORANDUM FOR FILE~~77455~~

The writer reviewed the December 20, 1968 draft of the Apollo Applications Program (AAP) inter-center interface control document (ICD) 50M13136, "AAP Audio Systems Criteria." A copy of the draft is attached (Attachment 1). Comments by the writer on the contents of this ICD referenced to the numbered sections of the ICD to which they apply are presented below.

3.0 Voice Requirements

It is recommended that a third subsection be added to this section containing the requirements for voice communications storage on-board the Orbital Assembly (OA) during the baseline mission and on-board the Lunar Module/Apollo Telescope Mount (LM/ATM) and Command and Service Module (CSM) during the alternate mission. The writer suggests that the following requirements be included in this new subsection:

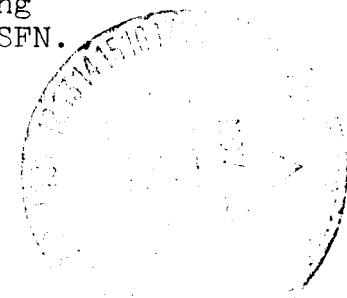
- (a) The crew members shall have the capability to route voice data present on the hardware system to on-board voice recording equipment for storage.
- (b) The capability shall be provided for the recording of voice annotations by one crew member concurrently on a non-interference basis with voice communications between the remaining crew members or among the remaining crew members and a station of the Manned Space Flight Network (MSFN) regardless of the locations of the various crew members.
- (c) Time correlation of recorded voice data with mission events shall be provided.
- (d) Dump of the recorded voice data to a station of the MSFN shall be possible simultaneously with real-time voice communications among the crew members and a station of the MSFN.

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(NASA-CR-106881) REVIEW OF AAP ICD
50M13136, AAP AUDIO SYSTEM CRITERIA
(Bellcomm, Inc.) 13 p



6.0 Audio System Configuration

6.2 CM Audio Centers

In order to ensure that voice communications can be conducted between two or more crew members on the same channel and that sidetone is provided to a crew member when using his headset, the writer recommends the following statement be added to this subsection.

- (a) A one-way transmission connection from the channel A microphone line to the channel A earphone line and a one-way transmission connection from the channel B microphone line to the channel B earphone line shall be provided by the respective audio centers of the CM used as part of the audio systems.

6.3 Audio Data Storage

The criteria in this subsection should be changed to reflect that the audio data storage capability will be provided in the Airlock Module (AM) rather than in the Saturn I Workshop (SIW) and that the selection of either channel A or channel B as the source for the audio data storage equipment will be accomplished in the AM rather than in the SIW during the baseline mission.

It is suggested that the following statement be added to this subsection.

- (a) Dump of the stored audio data to a station of the MSFN shall be accomplished via a radio frequency transmitter of the AM during the baseline mission or via a radio frequency transmitter of the CSM during the alternate mission.

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A. G. Weygand
A. G. Weygand

Attachment

MSFC FORM 422 (VERTICAL) (AUGUST 1969)

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PREPARED FOR: INSTRUMENTATION AND COMMUNICATION PANEL

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AAP INTER-CENTER INTERFACE CONTROL DOCUMENT

MSFC - Form 1916 (Rev July 1964)

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				50M13136

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1.0 GENERAL

1.1 Purpose - The purpose of this document is to establish the design criteria for the Audio System of the Orbital Assembly (OA). This Interface Control Document (ICD) is applicable to all vehicles of the Apollo Application Program (AAP) Flights 1 through 4 unless limited in any specific criterion.

1.2 Scope - These criteria shall apply to all new hardware designed to implement the Audio System. Where existing vehicles or hardware proposed for utilization in the program or system fail to meet any portion of this criteria, specific deviations shall be requested and decisions made as to modification, redesign or waiver.

1.3 System Definition - The primary purpose of the Audio System shall be to support all crewmen in the OA or on Extravehicle Activity (EVA) from the OA with voice communications and access to audio data storage equipment. The voice communications capability required shall be intercom between crewmen and between crewmen and the Manned Space Flight Network (MSFN). The system shall also provide, as required, support for gathering operational biomedical data, support for operation of the Caution and Warning System and controls and indicators related to the Audio System operation.

1.4 Alternate Mission - The Audio System shall be capable of providing support, as herein established, in the event of initiation of the Alternate (CSM/LM-A/ATM) Mission.

1.5 Limitations - This document defines criteria and does not intend to specify or infer design details for hardware or components.

2.0 APPLICABLE DOCUMENTS

The following documents are a part of this criteria ICD to the extent defined herein.

2.1

NASA

13M06022

AAP Caution and Warning System
Criteria Functional Requirements,
Marshall Space Flight Center,
Huntsville, Alabama.

TBD

Astronaut Audio Disconnect to Audio
Stations Interface Control Document,
Marshall Space Flight Center,
Huntsville, Alabama

2.2 Measurement Lists

50M12711

Instrumentation Program and Components List ATM Rack (ATM #1), Marshall Space Flight Center, Huntsville, Alabama.

No. TBD

AM Instrumentation Program and Components List, McDonnell Douglas Astronautics Company, Eastern Division, St. Louis, Missouri.

No. TBD

CSM Instrumentation Program, North American Rockwell, Downey, California.

3.0 VOICE REQUIREMENTS

The Audio System shall be a hardwire system providing communications throughout all carriers (CSM, MDA, AM, SLW and LM-A) in the OA by use of a headset or fixed mounted speaker and microphone.

3.1 Headset - Voice functions shall be provided by the Audio System for both the baseline and alternate missions with a headset (microphone and earphone). Each headset shall be live (talk and listen) whenever connected to the Audio system.

3.1.1 Duplex (talk and listen) voice communication between crew members within carriers of the OA.

3.1.2 Duplex voice communications between crew members in OA carriers and the stations of the MSFN.

3.1.3 Duplex voice communications between crew members performing EVA or IVA and crew members within vehicles of the OA.

3.1.4 Duplex voice communications between crew members performing EVA or IVA and the MSFN.

3.1.5 Voice data shall be routed to audio storage equipment by the Audio system.

3.2 Fixed Speaker and Microphone - Voice functions shall be provided by the Audio System for both the baseline and alternate mission without a headset by use of fixed speaker and microphone installations.

3.2.1 Simplex (talk or listen) voice communication between crew members within carriers of the OA.

3.2.2 Simplex voice communications between crew members in OA carriers and the stations of MSFN.

3.2.3 Simplex voice communications between crew members within vehicles of the OA and members performing EVA or IVA.

4.0 BIOMEDICAL DATA

The Audio System shall provide for transferring of operational biomedical signals from up to two (2) crewmen in the MDA, AM, SLW and LM-A to multiplexing systems. Signal requirements and multiplexing system programming are established by the measurement lists of section 2.2.

5.0 CAUTION AND WARNING (C&W)

The Audio System shall provide for support of the Caution and Warning System as specifically required by "AAP Caution and Warning System Criteria Functional Requirements - 13M06022".

6.0 AUDIO SYSTEM CONFIGURATION

The Audio System shall consist of two channels, designated A and B, of duplex audio service and biomedical data connections carried to audio stations located in all the carriers of the OA. Certain controls and displays of section 7.0 will be located on audio stations and signals to and from these controls and displays, as well as the C and W support requirements will be considered a part of the Audio System. Certain CM Block II audio system equipment will be integrated into the AAP Audio System after docking to the OA or the LM-A/ATM during the alternate mission.

6.1 Audio Station - Each audio station will make available the services of channel A and B for crew use. Two types of audio stations shall be utilized. The electrical connection interface between both types of station and the crewman will be physically identical and functionally in accordance with "Astronaut Audio Disconnect to Audio Stations Interface Control Document, No. TBD."

6.1.1 Audio stations shall be provided for crew members in a shirtsleeve environment in carriers of the OA during AAP Flight 1 through 4 in accordance with Table I.

Table I. Shirtsleeve Audio Stations		
CARRIER	GENERAL AREA	NUMBER
MDA	Docking Port	3
AM	Structural Transition Section	1
SIW	Crew Quarters	6
SIW	Forward LH ₂ Tank	4
LM-A	ATM C&D	1
CM	TBD	1

6.1.2 Each shirtsleeve audio station shall provide independent access for a crew member to channel A or B. Two crew members shall be capable of using each station simultaneously.

6.1.3 Each shirtsleeve audio station shall have the fixed speaker and microphone of section 3.2.

6.1.4 Audio stations shall be provided in accordance with Table II for crew members dressed for and conducting EVA or IVA activities.

Table II. EVA/IVA Audio Stations		
CARRIER	GENERAL AREA	NUMBER
AM	Lock	1
LM-A	TBD	1

6.1.5 The requirements of Section 6.1.2 shall also apply to EVA/IVA audio stations.

6.2 CM Audio Centers - The Audio System shall use the audio centers of each AAP CM (Flights 1, 3 and 3A) after docking to the OA or the LM-A/ATM for the baseline and alternate missions, respectively.

6.2.1 Connections between the channel A microphone line and the channel B earphone line; and the channel B microphone line and the channel A earphone line, shall be accomplished by control switch settings of the CM audio centers used as a part of the Audio System.

6.2.2 The capability of crew members to communicate with the MSFN as established in sections 3.1.2, 3.1.4, and 3.2.2 shall be through either channel of the Audio System from any audio station. Communications shall be by CM transmitters selected in the CM audio centers and initiated by utilizing an extension of the push-to-transmit (PTX) circuit of the Block II Apollo System.

6.2.3 Microphone and headset lines of the Audio System shall have DC isolation from the CM audio centers.

6.2.4 The external loading presented to CM audio centers by the channel A and B earphone and microphone lines shall not exceed the equivalent of one Apollo headset.

6.2.5 Any active components utilized to achieve line isolation of 6.2.3 and 6.2.4 shall be parallel redundant to the CM audio centers.

6.3 Audio Data Storage - Audio data storage capability shall be provided in the SIW for the baseline mission and the CM for the alternate mission.

6.3.1 Either audio data storage capability shall be capable of selecting either channel A or channel B as its source. Selection capability is required only within the SIW and CSM for the baseline and alternate mission, respectively.

6.3.2 Either audio data storage capability shall be capable of being enabled or inhibited from remote positions.

7.0 AUDIO SYSTEM DISPLAYS AND CONTROLS

The Audio System has requirements for displays and controls to permit monitoring and operation from various carriers of the OA.

7.1 Audio Stations - The two types of audio stations defined under 6.1 require different amounts of displays and controls. Display and control requirements of the EVA/IVA station are also requirements of the shirtsleeve stations. All stations require 28 vdc power to be supplied from the carrier.

7.1.1 Audio stations provided in accordance with section 6.1.4 to support EVA/IVA shall be located in proximity to EVA/IVA commodity supply connection points.

7.1.1.1 Control shall be provided at each station to "Enable" or "Inhibit" audio data storage of section 6.3. Controls shall be momentary. "Enable" shall activate voice data storage equipment as required. "Inhibit" shall deactivate voice storage equipment, but not interfere with telemetry pulse code modulation (PCM) data storage if it has been initiated from a central operating station or by command from the MSFN. "Enable" shall not be effective if storage system is in a data recovery mode. Gloved operation of controls on this station are a requirement.

7.1.1.2 Visual indication shall be provided at each station to show when audio data storage has been enabled and from which channel.

7.1.2 All audio stations provided in accordance with Section 6.1.1 to support shirtsleeve operations shall be identical. Stations shall be capable of being moved between carriers and locations with carriers in the event of a station failure.

7.1.2.1 The capability shall be provided to switch microphone input and earphone output of channel A or B to the fixed speaker and microphone of section 6.1.3.

7.1.2.2 The capability shall be provided to switch microphone input and earphone output of channel A or B to either crewman's station interface.

7.1.2.3 A gain control shall be provided to control the voice level output of the speaker of section 6.1.3. A positive disable control of the voice signal from the speaker shall be provided.

7.1.2.4 Momentary initiate (push-to-talk) provisions shall be provided for use of the fixed microphone of section 6.1.3.

7.1.2.5 Positive initiate (hands-free) provisions shall be provided for use of the fixed microphone of section 6.1.3.

7.1.2.6 Control shall be provided to permit "Sleep" at any shirt-sleeve station. This positive control shall inhibit the transfer of voice data from channel A or B to the speaker of section 6.1.3 or the earphones of headset(s) connected to channel A or B. This control shall be such that a "Call" signal received shall override the "Sleep" mode and permit the output of voice signals from the speaker.

7.1.2.7 A momentary "Call" signal shall be capable of being initiated from any shirtsleeve station and shall override the "Sleep" mode of section 7.1.2.6 established at any station(s).

7.1.2.8 A momentary push-to-transmit (PTX) switch shall be provided to initiate communications to the MSFN by use of the fixed microphone of section 6.1.3 and the CM audio center as specified in section 6.2.2.

7.2 Headsets - Certain controls must be provided to support the crewman operation on headsets attached to audio stations.

7.2.1 A gain control shall be provided to control the voice level output of the earphones of the headset of section 3.1.

7.2.2 A momentary PTX switch shall be provided to initiate communications to the MSFN by use of the microphone of the headset of section 3.1 and the CM audio center as specified in section 6.2.2.

8.0 AUDIO SYSTEM IMPLEMENTATION

Certain additional general requirements are established for implementation.

8.1 A means shall be provided to prevent arcing during mating and demating of connectors used in the audio system.

8.2 Electrical functions and mechanical elements of the audio system common to installations in carriers of the OA shall utilize identical equipment and arrangements.

8.3 Two channels (A and B) of Duplex Audio Service, including all related redundant indicator and control functions, shall be routed across carrier interfaces with independent routings (separate and isolated connectors).

9.0 ABBREVIATIONS

AAP	Apollo Applications Program
ATM	Apollo Telescope Mount
C and W	Caution and Warning
CM	Command Module
EVA	Extravehicular Activity
ICD	Interface Control Document
IVA	Intravehicular Acti
LM-A	Lunar Excursion Module Ascent Stage for AAP-Flight 4
MDA	Multiple Docking Adapter
MSFN	Manned Space Flight Network
OA	Orbital Assembly
PCM	Pulse Code Modulation
PTX	Push-To-Transmit
SIW	Saturn I Workshop
TBD	To be determined

BELLCOMM, INC.

Subject: Review of AAP ICD 50M13136
AAP Audio System Criteria

From: A. G. Weygand

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